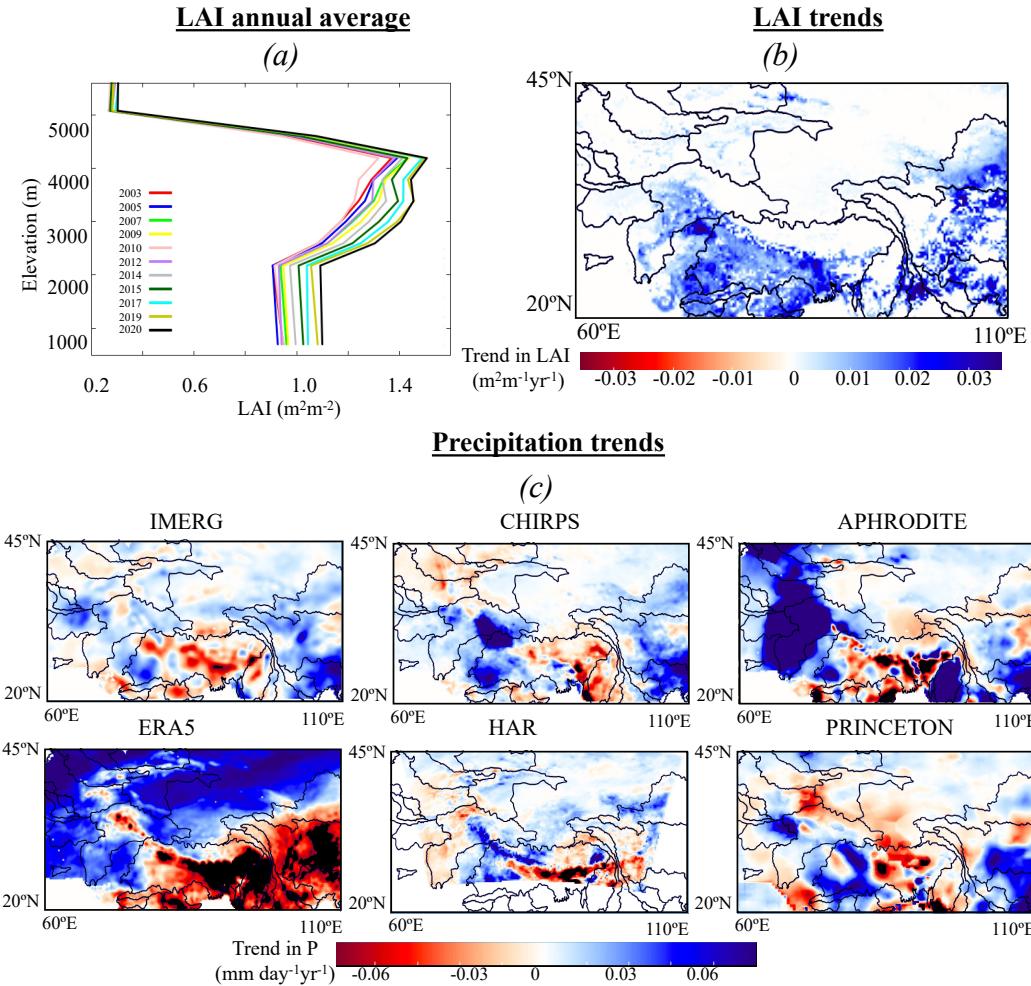


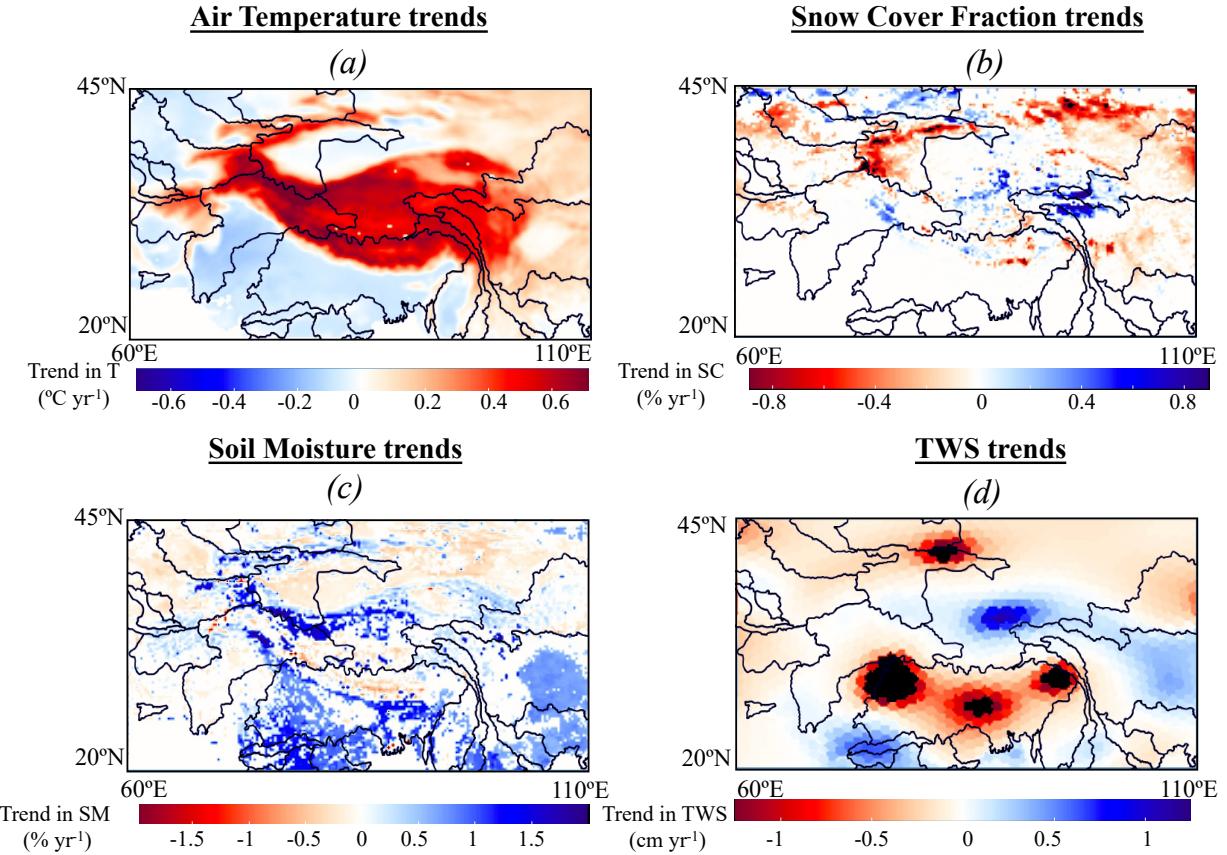
## Supplementary Information

Supplementary Figure 1 illustrates the increase in vegetation greenness in High Mountain Asia along with the changes in atmospheric conditions (precipitation and temperature), land surface processes (soil moisture and snow cover), and terrestrial water storage.



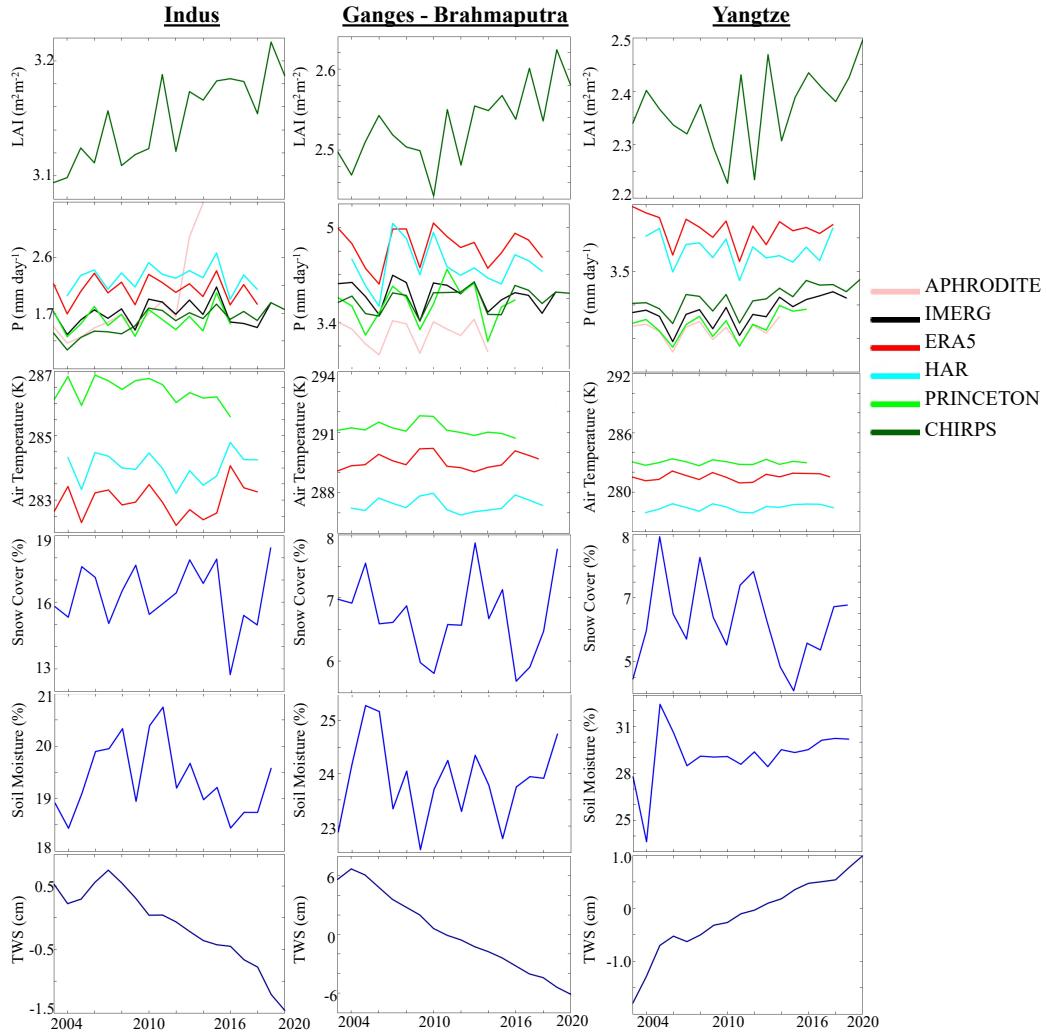
Supplementary Figure 1: (a) yearly LAI from 2003 to 2020 as a function of elevation, and the spatial distribution of the trends between 2003 and 2020 of (b) the leaf area index (MODIS LAI) and (c) IMERG, CHIRPS, APHRODITE, ERA5 HAR, and PRINCETON precipitation. Non-significant trends (confidence level 95%) are set equal to 0.

Supplementary Figure 2 illustrates the changes in temperature, land surface processes (soil moisture and snow cover), and terrestrial water storage.

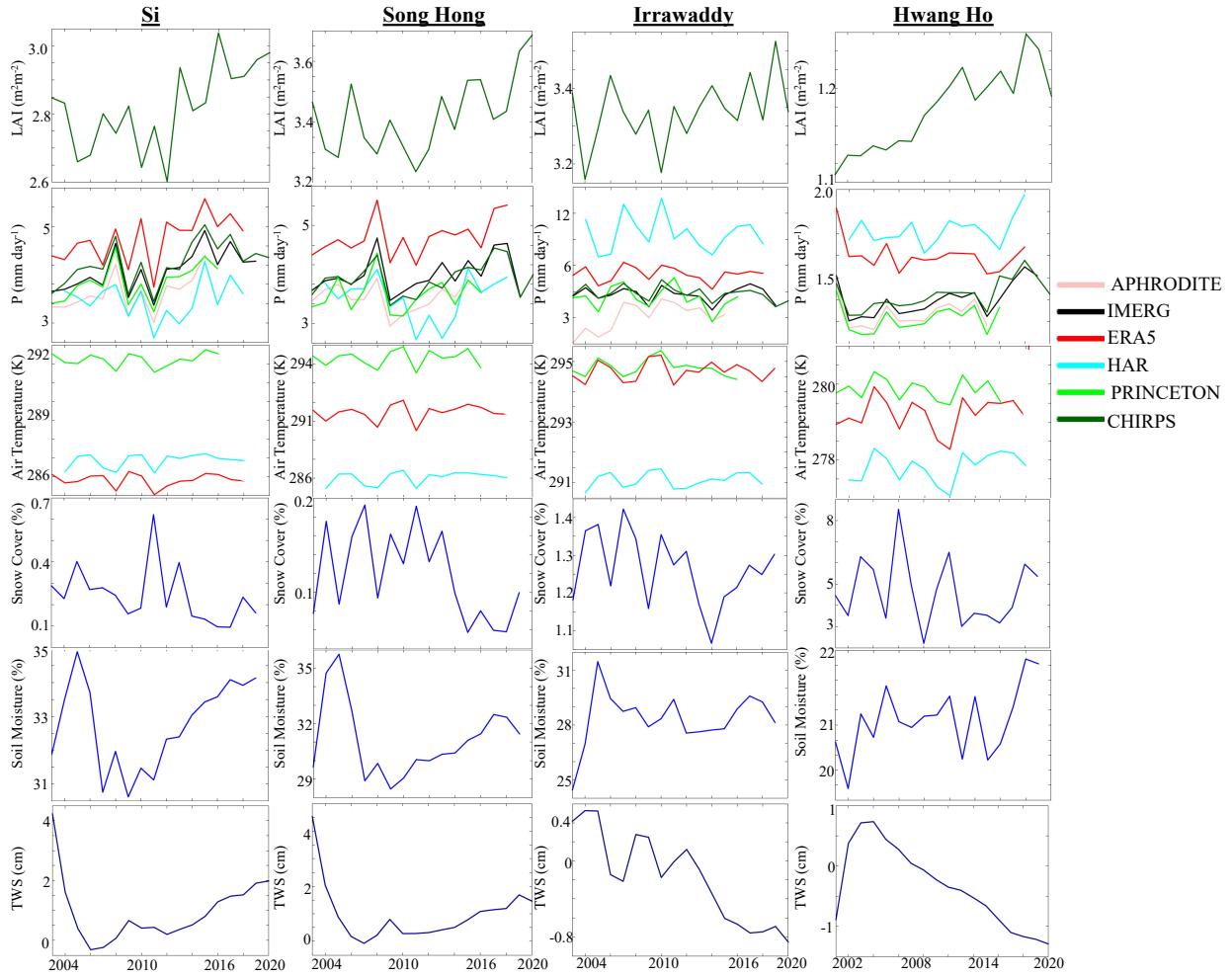


Supplementary Figure 2: Spatial distribution of the trends between 2003 and 2020 of (a) ERA5 air temperature, (b) MODIS snow cover fraction, (c) ESA CCI soil moisture, and (d) GRACE terrestrial water storage (TWS). Non-significant trends (confidence level 95%) are set equal to 0.

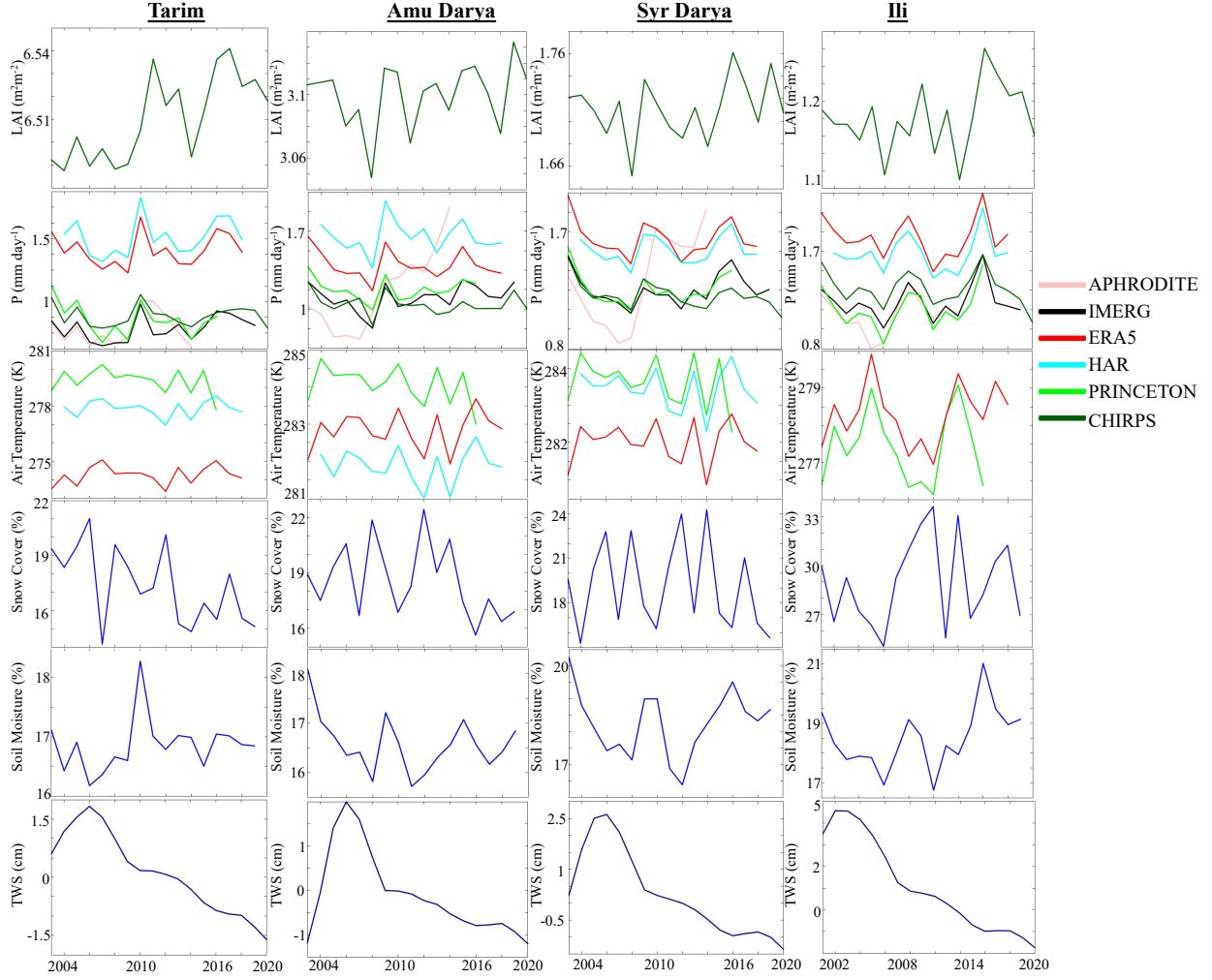
Supplementary Figures 3-5 showing the yearly variations of the basin average values of LAI, precipitation, air temperature, snow cover fraction, soil moisture, and TWS illustrate how soil moisture, snow cover, and TWS, responds to the changes in meteorological conditions and/or anthropogenic activities which in turn affect the LAI.



Supplementary Figure 3: Yearly variations of the basin (Indus, Ganges, and Yangtze) average values of Leaf Area Index (LAI), precipitation (P), air temperature, snow cover fraction, soil moisture, and Terrestrial Water Storage (TWS).



Supplementary Figure 4: Yearly variations of the basin (Si, Song Hong, Irrawaddy, and Hwang Ho) average values of Leaf Area Index (LAI), precipitation (P), air temperature, snow cover fraction, soil moisture, and Terrestrial Water Storage (TWS).



Supplementary Figure 5: Yearly variation of the basin (Tarim, Amu Darya, Syr Darya, and Ili) average values of Leaf Area Index (LAI), precipitation (P), air temperature, snow cover fraction, soil moisture, and Terrestrial Water Storage (TWS).